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The intimacy of Agassiz and Guyot, and the parallel courses of their lives, may be beautifully traced in the memoir of Agassiz which Guyot wrote for the National academy in 1877-78, but did not print until April of last year. It is a biographical gem. The two friends were born in Switzerland, were companions in study, were colleague professors in a post-graduate academy at Neuchâtel, were co-workers in glacial researches, were disturbed by political changes in their native canton, were emigrants to America, were neighbors in Cambridge, were comrades in sensible efforts to make science intelligible to the people, were investigators of American problems. In this memoir of his friend, Guyot has revealed himself by many a characteristic touch. After a fresh perusal of its pages, we are led to wonder how much scientific progress would have been delayed in this country, if it had not been for the inspiring and co-operating influence of these noble immigrants.

Like Faraday, Clerk Maxwell, Agassiz, Joseph Henry, and Benjamin Peirce, Guyot was a man who was devoted to research, who believed in carrying it to the utmost, and yet who was never troubled by the idea of a possible 'conflict' between science and religion. To him nature was a manifestation of God. Natural laws were divine laws. There could be no antagonism between them. On the contrary, he believed that the more we learn of the human soul, of the course of history, and of the structure of the world, the more harmonious will they appear as parts of one great plan. His faith, both in science and in religion, was so strong that his influence kept many clergymen from bigotry, many students from atheism. In him they saw a man to whom the study of science and the worship of God were alike obligatory.

THE ALASKA MILITARY RECONNOISSANCE OF 1883.¹

This expedition arose from a desire of the department commander in the military department in which Alaska territory is situated² to gain some military knowledge of the Indian tribes in that district, and especially in those parts recently opened by mining discoveries, fishing industries, and other causes. Besides gaining this information, it has also done something in the interest of science, especially for geography. The part of the route here treated

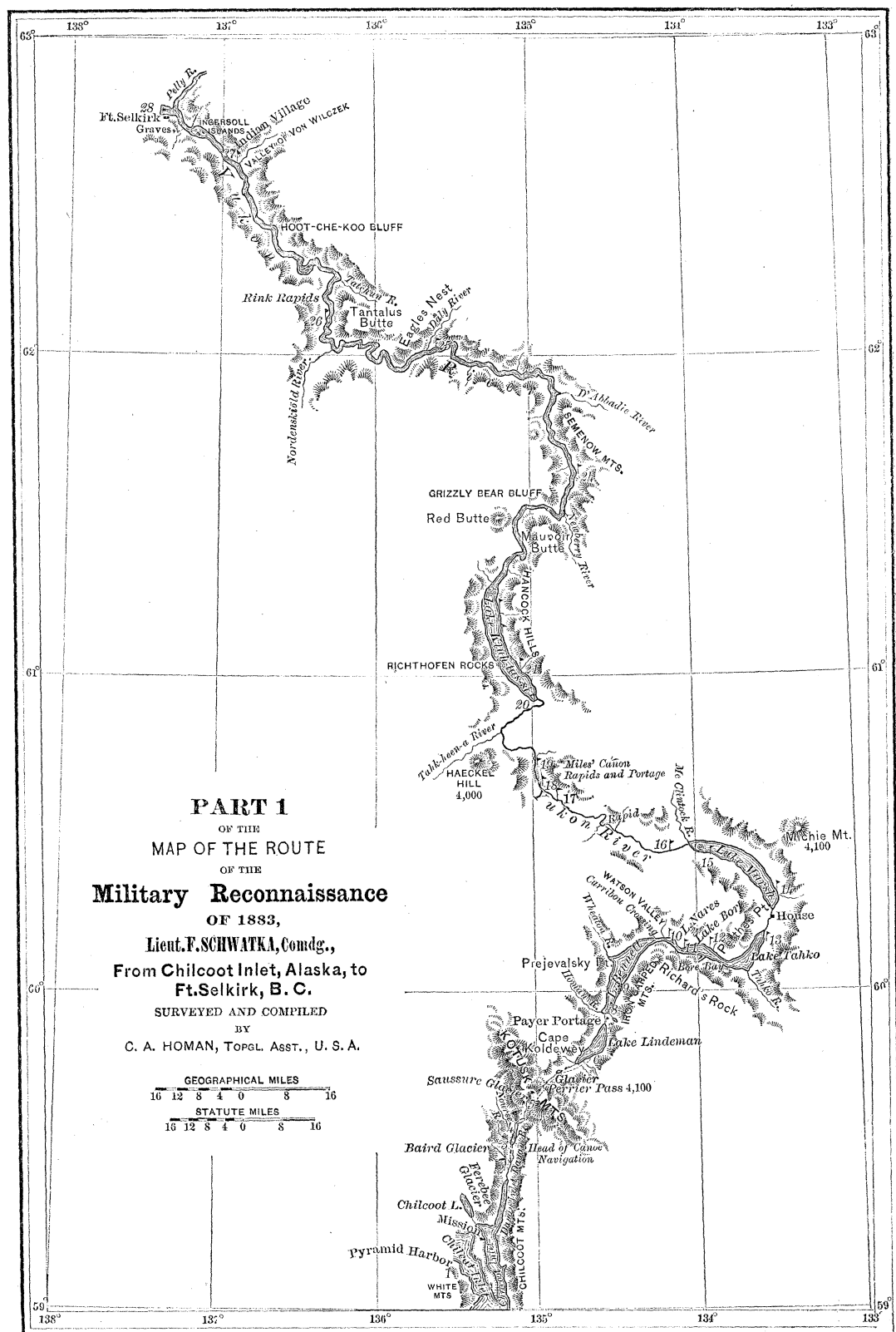
was almost unexplored, excepting the Chilcoot and Dayay inlets, and the portion from the Kotusk Mountains to Lake Lindeman, which had been traversed by the Krause brothers, sent out by the Bremen geographical society. If such an expression may be considered correct, it was really worse than wholly unexplored, in that the maps and books purporting to be authority over this section of the country were erroneous beyond the limits of sensible guessing. The party consisted of seven white persons, — two officers and five others, — and a number of Indians that varied from two to sixty or more.

There are said to be three or four passes through the glacier-clad mountains that separate the salt-water estuaries of the Pacific from the head waters of the Yukon, two of which are known as the Chilcat and Chilcoot trails; and over these two it has been known for about a century that Alaskan Indians of certain tribes had passed, in order to trade with the Indians on the sources of this great stream. The last (the Chilcoot) is the best of all the trails, and was the one undertaken by the party. Why this or the Chilcat route had not been picked out long ago by some explorer, especially those of comparatively recent dates, who could thereby have traversed the entire river in a single summer, instead of combating its swift current from its mouth, seems singular in the light of the above facts, and can only be explained by supposing that those who would place sufficient reliance in Indian reports to put in their maps the gross inaccuracies cited would also be likely to place reliance in the other reports of the same Indians; and these from time immemorial have pronounced this part of the river as unnavigable even for canoes, being filled with rapids, cañons, whirlpools, and cascades.

Formerly this Chilcoot pass had been monopolized by the Chilcoot Indians, who did not even allow the Chilcats — almost of the same blood — to use it: these were thus forced over the Chilcat route, which has an irksome portage of twelve or thirteen days to the head of the Tahk River (*Tahk-heen-a* of the Chilcats), a branch of the Yukon about half the size of the parent stream where it empties into the latter. Both of the bands on the upper Lynn Channel have united in keeping back the migration of the interior Indians to their waters in order to monopolize this trans-montane commerce. However, of late years, not only have the Chilcats used the mountain-pass of the Chilcoots, but both have allowed the *Tahk-heesh* or 'Stick' Indians of the interior to visit their own domain. I employed some of

¹ Explorations and surveys from Chilcoot mission, Alaska, to old Fort Selkirk, British America.

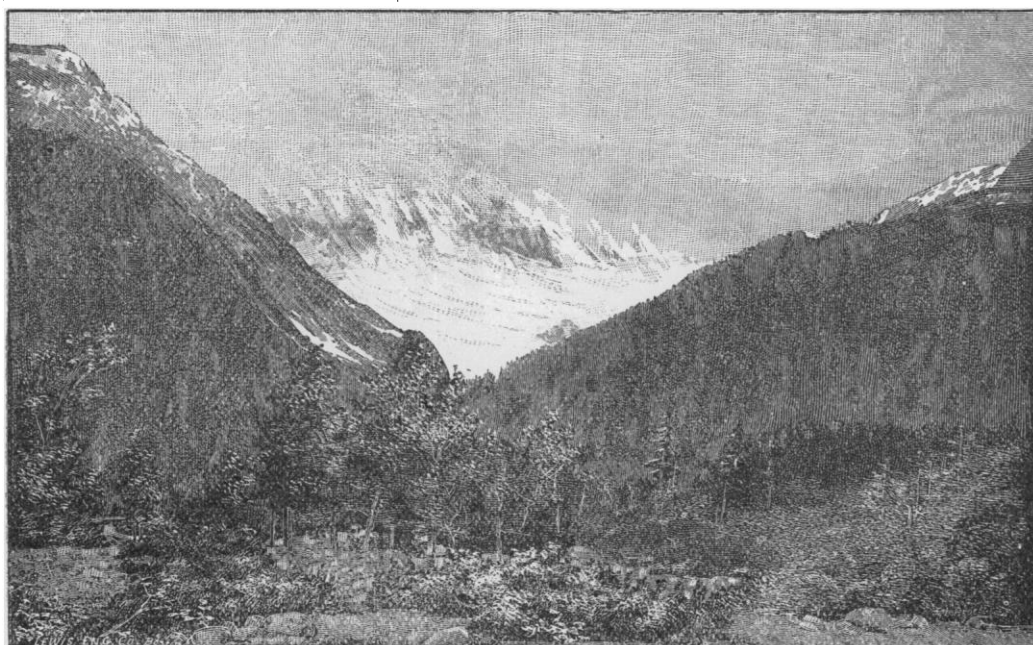
² Department of the Columbia, headquarters, Fort Vancouver, W.T.; Brevet Major-Gen. Nelson A. Miles, commanding.



all these three Indian tribes in my passage through their country.

Reaching Chilcat on the 2d of June, I found, as I had surmised from reports, that miners had pioneered the way some distance down the river in search of gold; but no one seemed to be much the wiser regarding the route, except that, as near as could be gleaned, they confirmed to a great extent the old Indian stories. My suggestion of a raft as my means of conveyance was ridiculed by whites and natives; and they could hardly conceal their contempt when the programme was known to be the passage, that summer, of the whole length of the river. Two or three hundred miles of tortuous lakes and a number of rapids, aggregating eight or ten miles in length, which the Indians never essayed, and around which the miners dragged their whip-sawed boats, were reported to exist, and supposed by all to be sufficient to wreck the raft theory of trans-

placed at my disposal by Mr. Spuhn, manager of the North-west trading company. At Chilcoot mission, four or five canoes were added to the already long chain, and the course resumed. Leaving Chilcoot Inlet, we entered another, that the Indians call the Dayay, an exact image of the fiord-like inlets characteristic of this part of the Alaskan coast; that is, having more the appearance of a large river than a salt-water estuary, its sides being immense precipitous mountains, covered three-fourths of the way to the top with a dense growth of spruce, fir, and pine, the latter holding to the lower levels, and capped with blue and white glacier ice that feeds innumerable and picturesque waterfalls coursing down the mountain sides. The mouth of the Dayay was reached that evening, our load of three or four tons lightered to the shore, the canoes and the bundles assorted and given to the different Indian packers, numbering over sixty. The packs varied from thirty-six to a



DAYAY VALLEY, LOOKING UP THE NOURSE RIVER VALLEY.

A glimpse of Baird Glacier covered with fog is given. The mountains holding the glacier being twice as high as the one shown on the left, their crests, if they had been visible, would not have shown in the photograph from which this illustration is made, being above the line where it is cut off. The lower edge of the fog-bank is just below the upper edge of the glacier. It is only at night that the fog-banks lift, when it is too late to take photographs.

portation; and, by the time I started, I felt very anxious myself regarding my plan.

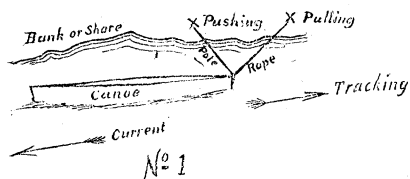
We left on the 7th of June from Chilcat, with thirteen canoes, towed by a steam-launch kindly

hundred and thirty-seven pounds in weight, the adults generally carrying a hundred pounds, and the boys according to their age and strength. Here was found a small camp of

Tahk-heesh Indians who were hunting black bear, said to be very numerous in this vicinity. During the evening we could hear many hooting-grouse (*Bonasa Sabinii*) in the spruce woods of the hillsides, this part of the day seeming to be their favorite time for this

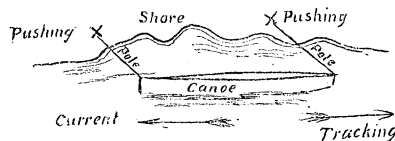
and Dayay, like most streams fed by glaciers, have their waters noticeably white and chalky. Not a 'bite,' nor a 'rise,' could be had in either with bait or flies, although the Indians catch trout in them in their fish-wears.

At the head of the Nourse River the Indians



X Indians

METHODS OF TRACKING A CANOE UP A RAPID.



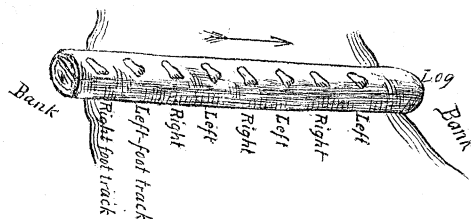
strain. I could but notice the very peculiar expressions of surprise given by the Chilcat Indians. Whenever one sets up a 'Ya-a-a!' at any thing that attracts his notice, especially the ludicrous mishap of a companion, every one in hearing, from two to two hundred, joins instantly; and a prolonged shout goes up that would astonish one not used to it. This may be repeated a number of times in a minute; and the suddenness with which it commences and stops is astonishing, and strongly reminds one of a gang of coyotes howling, or the bay-ing of Indian dogs, from which I think they have borrowed it.

The head of canoe navigation on the Dayay is ten miles from the mouth of the river, although fully fifteen are travelled by the canoe-men in ascending its tortuous course. They 'track' against the current in two ways, two persons being necessary for each method for a single canoe. The diagrams above will show these methods without further explanations.

The current of the Dayay is very swift, and it often takes two days' 'tracking' over the navigable part. Every few hundred yards or so the river has to be crossed, and oftentimes a hundred yards is lost in this undertaking. From the head of canoe navigation on the Dayay to the point where the Indian packers left the party is twenty-six miles, or the true length of the portage. Two miles and a half beyond the head of canoe navigation the Cutlah-cook-ah of the Chilcats comes in from the west. This is really larger in volume and width than the Dayay, the two averaging respectively fifty and forty yards in width by estimation. I shortened its lengthy name, and called it after Professor Nourse of the U. S. naval observatory. Large glaciers feed its sources by numerous waterfalls, and its cañon-like bed is very picturesque. Both the Nourse

say there is a very large lake. Its westward-bounding mountains are capped with an immense glacier, that could be traced along their summits for probably ten or twelve miles, and was then lost in the lowering clouds that these icy crowns form from the moisture-loaded atmosphere of the warm Pacific.¹ These light fogs are frequent in the warm days, when the difference of temperatures at the upper and lower levels is more marked, clearing up at night as they approach each other.

The march of the 10th of June was a very rough, fatiguing one of about ten miles, consuming from 7.30 A.M. till 7.15 P.M. It brought us to the foot of the mountain pass on the other side of which we should find the sources of the Yukon. I noticed that day that all my Indians, in crossing logs over streams, always turned the toes of both feet in the same direction (to the right), although they kept the body square to the front, or nearly so, and each foot passed the other at every step, as in natural walking. The advantage to be gained was not obvious to the author; as the novice, in attempt-



POSITION OF THE FEET IN WALKING A LOG, AS PRACTISED BY THE ALASKAN INDIANS.

ing it, feels much more unsafe than in ordinary walking. Every evening was spent by the Indians in their gambling games, their orgies

¹ This glacier (see illustration, p. 222) was named after Prof. S. F. Baird of Washington, D.C.

often continuing until midnight or past. This, added to their rapidly improvised birchbark hats with pictures upon them that would prohibit their being sent through the mails, does not speak well for missionary efforts among them.

On the 11th we crossed the pass (Perrier Pass), ascending to forty-one hundred feet

hill, on a level, or even with a slight descent, always stepped in each other's tracks, so that my large party made a trail that looked as if only five or six had passed over; but, when going down a steep descent, each one made his own trail, and they scattered out over many yards. I could not but be impressed with the idea that this was worth considering in estimat-



A VIEW IN THE DAYAY VALLEY.

A finger of the Saussure Glacier is seen peeping round the mountain, the rest being covered with fog.

above the sea-level, being among the clouds formed by the glaciers in the upper third of the ascent. It was the usual severe alpine climbing; the agility and endurance of the Indian packers, with their immense loads, almost surpassing belief. The entire distance of six or seven miles was on the deep snow, the depth of which could only be inferred. Once through the Perrier Pass, the descent is rapid for a few hundred feet to a lake of about a hundred acres in extent, which was yet frozen over and the ice covered with snow. It very much resembled some old extinct crater, and I doubt not but that it was active in ancient times. Here there was no timber, nor even brush, to be seen; and the gullies of the granite hills, and the valleys deeply covered with snow, gave the whole scene a decidedly arctic appearance. My Indians, in following a trail on snow, whether it were up

ing their numbers under such circumstances. From the little crater-like lake at the very head of the Yukon, the trail leads northward through a valley that converges to a gorge; and while on the snow in this we could hear the water gurgling under the snow bridge on which we were evidently walking. Farther on, where these snow arches were too wide, they had tumbled in, showing in many places deep perpendicular snow-banks, often twenty to twenty-five feet in height. Passing by a few small lakes on our left, some yet containing floating ice, we caught sight of the main lake late in the afternoon, and in a few hours were upon its banks. It is a beautiful sheet of water, ten or eleven miles in length,¹ and looked not unlike a limited area of one of the broad inland

¹ Named in honor of Dr. Lindeman of the Bremen geographical society.

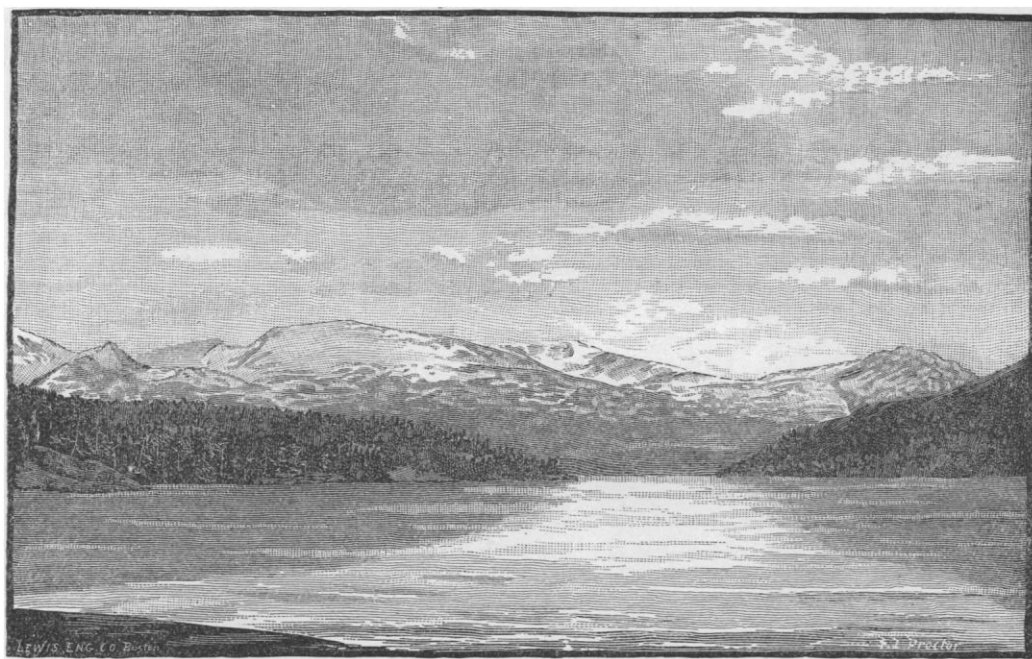
passages traversed by the steamers plying to Alaskan ports farther south. Fish were absent in these glacier-fed streams and lakes, but we managed to kill a few dusky grouse (*Tetrao obscurus*) and green-winged teal (*Nettion carolinensis*) to vary the usual government ration; but all were tough beyond measure, it being their breeding-season. Over Lake Lindeman were seen sea-gulls and the graceful little arctic tern that I recognized as an old and garrulous companion. Of large game, a small black bear cub was the only thing seen; although mountain goats were abundant a short distance back in the hills, one having been seen by us in the Perrier Pass.

The next day we commenced building our raft on Lake Lindeman; although the logs were very small, consisting of dwarfed spruce and contorted pine. Fifteen by thirty feet was considered large enough until we commenced to load it, when we were forced, during a heavy gale on the 15th, to send it ahead with but half a load and three men, the remainder

reached, where birchbark canoes commence. The remainder of the party took a whole day in struggling overland through the tangled brush and marshes of the gullies, and climbing the steep, smooth granite banks that separate them from the ridges covered with a labyrinth of fallen timber.

At its northern end Lake Lindeman is drained by a small river fifty to sixty yards in width, full of rapids and cascades, and about a mile in length, where it empties into a large lake that I named after Mr. James Gordon Bennett, a well-known patron of American geographical research.

The raft was shot through the connecting river, June 16, and the dimensions enlarged to fifteen by forty; although, counting all projections, it really came nearer sixteen by forty-two. Around this series of rapids the Indians portage their effects on their backs; and I named it Payer Portage, after Lieut. Payer of the Austro-Hungarian expedition of 1872-74. By the 17th of June, at midnight



LAKE LINDEMAN.

The view is taken from the upper (southern) end of Payer Portage, looking (south) toward Kotusk Mountains. Perrier Pass is on the extreme right wrapped in fog. There are higher ice-capped mountains in the distance, not shown here.

of the material being stowed in two dilapidated wooden canoes, — fair samples of the very few that exist from here until old Fort Selkirk is

it was light enough to read print like that of *Science*, and continued so through the month, except on very cloudy nights. Har-

lequin ducks were noticed on the southern end of Lake Bennett, and black and brown bear and caribou tracks in the valley of a small stream emptying into the lake near by. A couple of Tahk-heesh Indians were here encountered, one of whom stammered considerably. Among my Chilcat packers I also noticed one that was deaf and dumb, and two or three afflicted with cataract in the eye. On the 19th of June we commenced traversing Lake Bennett. Through the ice-fields capping the timbered mountains to the east of the lake protruded a great many dull red rocks and ridges, specimens of which, found in the terminal moraines of the little glaciers putting down the gulches, showed iron; and I named this bold range the Iron-capped Mountains. By three p.m. it was blowing a gale; and by five the waves were washing over our raft, and threatening to tear it to pieces, for there was not a single log that extended the whole length of the raft proper. We accordingly put into a cove, where we obtained four large spruce to strengthen the raft, and on the 21st resumed the journey, reaching the northern end of Lake Bennett that evening. The lake is thirty miles long, and flanked by precipitous hills three thousand to thirty-five hundred feet high, capped with glaciers. At its north-western face there come in a couple of streams, forming a wide, flat, and conspicuous valley that we all felt sure was going to be our outlet as we approached it. Several well-marked buttes spring from this valley, giving it a very picturesque appearance; its largest river being sixty to seventy-five yards wide, but quite shallow. I called it Watson valley, after Professor Sereno Watson of Harvard.

The draining river of Lake Bennett is about two hundred yards wide, and is called by the Tahk-heesh, 'the place where the caribou cross;' these animals, in their migrations, fording its wide, shallow current, and passing out and in through Watson valley. It is hardly two miles long before it expands into another lake, whose general course now turns to the east; and our old friend, the steady, summer south wind, was of no avail for sailing our huge craft. Although this lake (Lake Nares, after Sir George Nares) was but three or four miles long, its eastern trend kept us three days before we got a favorable wind, the banks not being good for tracking. Although small, Lake Nares was one of the prettiest in the lacustrine chain. The country was perceptibly opening; and trap, granite, gneiss, and metamorphic and eruptive rocks generally, were giving way to the sedimentary and frag-

mental. Many level places were appearing, the hills were less steep, and the snow disappearing from their crests. Roses of varying hues were in bloom, and also wild pansies; while wild onions lined the lake-shore in profusion, and everywhere there was a general change of verdure, and variation for the better. Grand terraces in beautiful symmetry on the two sides of the lake plainly showed its ancient and subsiding levels. These, too,—in a less conspicuous manner, however,—had been noticed on the northern shores of Lake Bennett. Lake Nares drains through a short river of a hundred yards into another lake¹ about eight miles long, and on whose limited shore-line I was compelled to make two camps and a half-dozen extra landings, so baffling was the wind on which we had to depend. Two bungling side-oars on the huge raft allowed us to make about a half a mile an hour with laborious effort, a wall-tent for a sail driving us along as fast as two miles and a half under the most favorable wind. An oar on the bow and stern gave us steering apparatus, and a dozen strong wooden poles served us as pries over many a lake and river bar of sand, gravel, and mud.

During one of these temporary landings on the shores of Lake Bove, some of my Indians set fire to the green spruce-trees by a large blaze kindled under them, and a dense volume of smoke ascended high in the heavens. Late that day a smoke was seen north of us some ten or fifteen miles away, and our Indians told us it was an answer to the one they had accidentally made that morning. These signal-smokes between the two bands were formerly quite common; the Chilcats thus heralding to the Tahk-heesh that they had crossed the Kotusk Mountains, and were in their country for trading purposes. Not many years ago, as I was told by an old Hudson-bay trader in these parts, this Chilcat-Tahk-heesh trade has been known to be so great that not less than seventy-five or eighty of the Chilcats and Chilcoots crossed the mountains twice annually, each carrying a hundred pounds of trading-material, or a grand total of eight tons, to be exchanged for furs that were collected from a wide circuit by intertribal commerce. Fort Selkirk, established by the Hudson-bay company near the junction of the Pelly and Yukon, interfered with their trade for a brief period, until 1851, when a war party of Chilcats extended their trading-tour nearly five hundred miles in order to destroy it; and its blackened chimneys still attest their success.

Lake Bove has a deep bay in its southern

¹ Lake Bove, after Lieut. Bove of the Royal Italian navy.

face; and into this, our Indians reported, empties a large river. Rounding Point Perthes (after Justus Perthes of Gotha), nearly white with its covering of limestones, some of them almost true marble in their brilliancy, we enter Tahko Lake, eighteen miles in length by our measurement (forty-five, according to one guess on record). A well-deserved remark regarding conjectural geography in order to 'fill out' maps, charts, or books, I hope will not be found amiss at this point. In one of these we were given to understand that from here the Indians make Fort Selkirk in a day and a half in their birchbark canoes. There are no birchbark canoes used on the lakes, nor as far as Selkirk. The very few Indians living on the four hundred and thirty-three miles between Tahko and Selkirk never stay in their cramped wooden canoes over six hours during a day, and would therefore have to paddle over each mile at the rate of one minute and thirty-five seconds.

Tahko Lake receives a small stream on the south, which, followed up, leads to one of the mountain passes that debouch upon the waters of the Pacific, so said our Indians. The same authorities gave us to understand that it drains smaller lakes, and has a smaller bed than the rivers and lakes through which we had passed; and its appearance, as we sailed by, seemed to confirm their opinions, thus showing that we had been on the main stream, or the Yukon proper.

(To be continued.)

FLOODS IN THE OHIO.

No river of the same magnitude fluctuates in depth so much as the Ohio. Twice, or oftener, during most years, the river rises at Cincinnati to a stage of forty-five feet six inches by the gauge at the water-works, when the occupants are compelled to vacate the premises at the foot of Commercial Row. A greater depth than this is a flood, and occasions more or less loss and suffering. Extreme low water is two feet, and extreme high water of February, 1883, was sixty-six feet four inches, — a difference of sixty-four feet four inches.

The gauge at the water-works was fixed in 1858, and all observations since then are referred to that standard. This gauge is intended to show the depth of water on two principal bars near Cincinnati, — Four-Mile bar above, and Rising-Sun bar below, the city. All observations of the stage of water of which we shall speak have been reduced to this gauge.

We may mention the noted floods preceding the establishment of the gauge in 1858.

1774. — It is traditional that at about this year there was a great flood in the Ohio. Vol. i. p. 343, of the *American pioneer*, states that two white hunters were detained some time in March of this year at the mouth of the Big Kanawha by a remarkably high freshet, which, from fixed marks on Wheeling Creek, is supposed to have been equal to that of 1832.

1789. — Various records show that there was a remarkable flood this year observed by the first white settlers, which must have been of much longer duration than any of later date.

1792. — It is within the recollection of some now living, that four years after the settlement of Losantiville (Cincinnati) there was a flood that covered the land on which Columbia now stands. The stage of water must have been sixty feet or more.

1815. — Another great flood occurred this year, but it was of less magnitude than that of 1792.

1832. — There are several points in Cincinnati where permanent high-water marks were made on Feb. 18, 1832; and they almost exactly agree in showing that the stage of water was then sixty-four feet three inches. The population of Cincinnati was then twenty-eight thousand; and, as the city was situated upon the river-bank, nearly the whole of it was inundated by a flood, which increased continually for ten days.

1847. — Cincinnati contained about ninety-six thousand people at this date. The river began to rise on Dec. 10, and on the 17th reached sixty-three feet seven inches.

The following table records the highest stage of water at Cincinnati each year since 1858, as well as those just given for 1832 and 1847: —

Year.	Date.	Feet.	Inch.	Year.	Date.	Feet.	Inch.
1832	Feb. 18,	64	3	1871	May 13,	40	6
1847	Dec. 17,	63	7	1872	April 13,	41	9
1858	June 16,	43	10	1873	Dec. 18,	44	5
1859	Feb. 22,	55	5	1874	Jan. 11,	47	11
1860	April 16,	49	2	1875	Aug. 6,	55	5
1861	April 19,	49	5	1876	Jan. 29,	51	9
1862	Jan. 24,	57	4	1877	Jan. 20,	53	9
1863	March 12,	42	9	1878	Dec. 15,	41	5
1864	Dec. 23,	45	1	1879	Dec. 27,	42	9
1865	March 7,	56	3	1880	Feb. 17,	53	2
1866	Sept. 26,	42	6	1881	Feb. 16,	50	7
1867	March 14,	55	8	1882	Feb. 21,	58	7
1868	March 30,	48	3	1883	Feb. 15,	66	4
1869	April 2,	48	9	1884	Feb. 14,	71	2
1870	Jan. 19,	55	3				

The flood-stage of 1875 was remarkable as occurring in summer, when the river is in most years low.